Near and Far Sciences for Illinois  
Geology Workshop  /  Region 7 (Chicago)  
November 7 and 8, 1997

FIELD TRIP OVERVIEW

A Half-Day Geologic Field Trip to the Chicago Lakeshore, Wolf Lake, and the Observation Building at Thornton Quarry

Comparison of the Burnham Plan for lakeshore filling and the present-day lakeshore. Lakefill has produced about 5.5 square miles of land along Chicago's shore (from Chrzastowski, 1991a).

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STOP 1
Lincoln Park

History

Prior to the Civil War, some of what is now southern Lincoln Park was the Chicago City Cemetery. The cemetery was established in 1842. Most of the Chicago inhabitants who died between 1842 and 1866 were buried here, including thousands of Confederate soldiers who died in captivity during the Civil War at Camp Douglas located just outside Chicago. As the park was being developed in the late 1800s, nearly 4,000 bodies from the cemetery were excavated and moved to other Chicago cemeteries. Today, only one mausoleum and one grave marker remain.

During the Great Chicago Fire of September 1871, the present area of the park near North Avenue was the northern limit of fire damage, and much of what is now the present park grounds was a place of refuge for many people who fled northward to escape the northward advance of the fire (Figure 1).

Geology

Most of Lincoln Park once consisted of a series of north-south trending sand ridges and intermediate swales that were formed along the shore of ancestral Lake Michigan between about 3,000 to 2,000 years ago. Some of these relict beach ridges remain today as elongate grass- and tree-covered “hills.” Many of the former swales were excavated to create ponds such as North Pond and South Pond (Figure 2).

Human modification to the local landscape began in the early 1900s as filling was done along the lakeshore to create new park land and what is now the right-of-way for Lake Shore Drive. In Lincoln Park near Stop 1 (Figure 2), the pre-fill shoreline runs along the west side of Diversey Harbor and the Lincoln Park Lagoon.

Lincoln Park includes some of the unique features to be found along the Chicago lakeshore. Near Montrose Harbor (see cover map) is the most lakeward extension of any lakefill parks. Here land was extended up to three-quarters of a mile into the lake into water depths of 18 to 20 feet. At North Avenue Beach (Figure 2), a partially submerged steel-sheetpile wall (or “bulkhead”) was constructed to hold the beach sand in place. This is an example of what is called a “perched beach” since it is held-up or “perched” above the adjacent lake bottom. North Avenue Beach is one of the oldest perched beaches built in the U.S.

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It was the thick sand deposits in the Lincoln Park vicinity that made this a prime site for a city cemetery. These sand deposits assured good drainage which is an important consideration in cemetery siting.

Most of the structures that protect the lakeward edge of Lincoln Park are now decades beyond their design life and they are in serious disrepair, particularly north of Fullerton Parkway. Construction of new shore-defense structures is necessary and is planned as part of the $841 million lakefront rebuilding project now getting underway. This lakefront rebuilding is further discussed in the write-up for Stop 2 (Oakwood Promontory).
Figure 1. Etching of people fleeing northward into what is now Lincoln Park (site of former Chicago City Cemetery) to seek refuge from the advancing Chicago Fire. Lake Michigan is seen in the distance (original from Harper's Weekly, Nov. 11, 1871; copied from Lowe, 1979).
Figure 2. Bathymetric chart for the lake area adjacent to southern Lincoln Park. Note the linear submerged bulkhead at North Avenue Beach which was built to hold the beach sand in place and thus form a "perched beach" (from NOAA Chart 14926, 1982).
STOP 2
Oakwood Promontory

History

Following the success of the Columbian World's Exposition of 1893, there was great interest in constructing a lakeshore park to connect the Chicago Loop with the site of the former World's Fair at what is now Jackson Park. Architect and planner Daniel H. Burnham (1846-1912) designed such a lakeshore park, and later included an expanded version of this design in his landmark work entitled "Plan of Chicago."

Today, Burnham Park includes closely resembles the plan that Burnham presented for this lakeshore reach (see map comparison on guidebook cover). From atop the high ground at Oakwood promontory, the curvilinear design of the shoreline is clearly seen, which was a key component in Burnham's designs. Along all of Burnham Park the original plans called for construction of a series of offshore islands. Only one of these was ever built, the northernmost island (called Northerly Island; see cover map) which today is occupied by Meigs Field.

Geology

The pre-lakefill shoreline along Burnham Park lies on what is now the west side of Lake Shore Drive; it was generally along the right-of-way for the Illinois Central Railroad (Figure 3). When the tracks were first laid in the mid 1800s they ran through low-lying sand dunes adjacent to the beach.

Filling for construction of Burnham Park occurred in the 1920s. The construction procedure involved building a timber-crib along the desired shoreline, filling the crib with rock, pumping sand behind the crib to form the new land, and then capping the crib with a stepped arrangement of quarry stones. Most of the sand used as fill was mined from the dunes or shallow lake-bottom along the Indiana shore, and brought to this site by hopper-dredge ships. Some fill was obtained by dredging the lake bottom just lakeward of the shore structures (called "revetments"). Elongate dredge holes up to 400 ft wide and 4000 feet long remain along the lake bottom just lakeward of the shoreline. Parts of these dredge holes are as much as 26 feet deep, making them as much as 13 feet deeper than the nearby lake bottom (Figure 3). Shoals (i.e., shallow areas) to the south of Oakwood Promontory (Oakland Shoal and Morgan Shoal) are formed by outcrops of Silurian dolomite bedrock similar to that seen in Thornton quarry at Stop 5.

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Burnham Park contains the most seriously deteriorated shore structures anywhere along the Chicago lakeshore (inset photo in Figure 3 and Figure 4). Reconstruction efforts will begin in 1998 in the vicinity of 31st Street Beach, and then continue southward. As of late summer 1997, the lake-bottom geology was being evaluated along the entire Burnham Park. This information is needed to assist in the final designs and in construction.

The new structures will have a stepped configuration intended, in part, as a tribute to the historical character of the Chicago lakeshore. The major difference between the new and existing structures is that a steel wall ("sheetpile") will be used as an impermeable barrier along the underwater face of the new structures. This will assure long-term retention of fill material. The life expectancy of these steel-faced structures will exceed 100 years. The reconstruction is a partnership between the U.S. Army Corps of Engineers, the Chicago Park District, and the City of Chicago.
Figure 3. Bathymetric chart for the lake area adjacent to Burnham Park between 31st Beach and 49th Street. Photo inset shows the deteriorated revetments along the Burnham Park shoreline (from NOAA Chart 14926, 1982; photo May 17, 1990 by ISGS).
Wood piling or wood bulkhead deterioration, breakage and loss provides lakeward exposure of the revetment rock fill.

Revetment rock fill is dispersed onto the toe protection by wave surge action as well as gravity and freeze-thaw. Revetment capstones tilt, slide and fall as they lose their underlying support.

Figure 4. Diagram showing the type of deterioration common to the timber-crib revetments along the Chicago lakeshore (from Chrzastowski, 1991b).
STOP 3
South Shore Cultural Center

Note: This is a 15-minute rest stop

History

Today, the South Shore Cultural Center is operated by the Chicago Park District as a meeting place available to the public, but earlier in its history this facility was a private playground for Chicago’s wealthy.

The buildings and grounds were originally called the South Shore Country Club. The first club house was constructed in 1906. The only remaining part of that original building is the Ballroom on the south end of the existing main building (called the “Club House”). The Club House was constructed in 1916 and, at that time, construction included building the Garage, Stable Buildings, and Shooting Club. All of these buildings were designed by the architectural firm of Marshall and Fox renowned for Chicago hotel and apartment building designs including the Drake and Blackstone Hotels and 1550 North State Parkway.

For most of the early 20th century the South Shore Country Club was an elegant private club. But as the nearby south shore neighborhoods declined in property value in the 1950s and 1960s, the South Shore Country Club also declined and fell into serious disrepair.

The property was purchased by the Chicago Park District in 1972 to add to public holdings along the Chicago lakeshore. In 1975 the site was listed in the National Register of Historic Places. In 1984 the Chicago Park District rehabilitated the Club House using the color schemes first developed by Marshall and Fox. Additional rehabilitation is planned or underway for the Pergola, Garage, and Stable Building. Recently (1997), the old shooting club building was demolished.

Geology

The South Shore Cultural Center is built atop sand deposits that were deposited along the shore of ancestral Lake Michigan. In the immediate area of the Cultural Center, these sand deposits accumulated about 2,000 years ago. The shoreline at the Cultural Center has been significantly modified by lakefill and construction of bulkheads and groins to form a protected beach area and small-boat basin (Figure 5).

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The timber structures that form the protected beach area and small-boat basin are in serious disrepair and will need to be rebuilt. A major opportunity exists to redesign the shore-protection structures to enhance the lakeshore recreational opportunities at the South Shore Cultural Center.
Figure 5. Bathymetric chart for the lake area in the vicinity of South Shore Cultural Center (from NOAA Chart 14926, 1982).
STOP 4
William W. Powers Conservation Area

History

The William W. Powers Conservation Area is managed by the Illinois Department of Natural Resources (DNR). The state originally acquired 160 acres in the area in 1947. Subsequent acquisitions have brought the total acreage to the present-day 580 acres. Of this total, 419 acres is water area of Wolf Lake (Figure 6).

The park was originally known as the Wolf Lake Conservation Area, but in 1965 the Illinois legislature approved changing the name to William W. Powers Conservation Area in honor of this former state legislator who was known for his work in promoting recreational opportunities in the district.

Geology

Wolf Lake is one of a several naturally occurring lakes in the area that include Lake Calumet to the west and Lake George to the east (in Indiana). These lakes occupy low areas between ancient beach ridges that formed about 2,000 years ago as Lake Michigan water levels were declining and waves deposited beach ridges in broad, arcuate shapes across what is now the Illinois-Indiana state line. Lake Calumet and Wolf Lake are remnants of a lobe of ancestral Lake Michigan that once extended southward across a broad area at the state line.

In its natural setting, Wolf Lake was a shallow lake surrounded by extensive wetlands. Lake depths were originally no more than 3 to 5 feet. Dredging has since formed localized areas with depths of 15 to 20 feet (Figure 7). This dredging was apparently done to obtain sand and clay for use as fill in constructing nearby highways. Related to the dredging, bands of fill were placed in Wolf Lake to create road beds and rail beds to aid in moving the dredged material. These fills have segmented the lake into several enclosed or semi-enclosed basins.

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Powers Conservation Area has preserved a "window to the past" in terms of the extensive wetlands, small lakes, and sand ridges that once dominated what is now the industrial/urban complex between Lake Calumet, Illinois and Gary, Indiana. This conservation area preserves a unique, near-natural landscape within the Chicago city limits. Considering the types of activities that you would not expect to find within the city limits, Powers Conservation Area has the distinction of being place within the city where duck hunting is allowed.

Human modifications to Wolf Lake have caused some unique lake-management concerns. For example, the deep dredge holes and the bands of fill that segment the lake are two factors that can form pockets of poorly circulated water and restrict water exchange. This in turn can cause reduced water quality. In addition, the dredge holes also present a safety concern for fishermen who may wade into the lake.
Figure 6. Map of the William W. Powers Conservation Area (left) and Wolf Lake bathymetric map (right). Park map from DNR WWPCA brochure; bathymetric map from Illinois State Natural History Survey, Austen et al., Aquatic Ecology Technical Report 93/9 (1).
History

Sand Ridge Nature Center is operated by the Forest Preserve District of Cook County. The facility opened to the public in 1962. An extensive reconstruction and renovation project began in 1992 and was completed in 1993. The new facility provides enhanced opportunities for education and recreation.

Geology

The Sand Ridge Nature Center rests atop the Toleston spit which was an elongate beach deposit that originated on the western Indiana shore of ancestral Lake Michigan and extended westward across the Illinois-Indiana state line. The Center is located between the Little Calumet River to the south and the Grand Calumet River to the north (see map on page 1; Location of Field Trip Stops). At the time that this sand deposit formed (about 3,800 years ago) an embayment of ancestral Lake Michigan occurred to the north, and a lagoon (Calumet lagoon) occurred to the south along what is now the valley of the Little Calumet River (Figure 7A). As lake level declined over the next few thousand years, the Calumet lagoon dried and the Little Calumet River flowed westward across the former lagoon bottom (Figure 7B). Continued decline in lake level over the next few thousand years, and additional deposition of beach sands, forced the mouth of the river ever farther eastward (Figures 7C and 7D). This eastward flowing reach has been named the Grand Calumet River to distinguish from the westward flowing Little Calumet River.
Figure 7. Diagram showing stages in the changes to the shoreline and river drainage in the vicinity of the Illinois-Indiana state line over the past 3,800 years. The map sequences in "B" and "C" show how Lake Calumet was formed by the southward advance of beach deposits that "cut it off" from the ancestral Lake Michigan (from Chrzastowski and Thompson, 1994).
History

Thornton, Illinois, has been the site of quarry operations since earliest settlement in northeast Illinois and Northwest Indiana. In the early 1800s small quarries were opened to obtain lime and building stone. The present-day arrangement of five connected quarry pits represents over 100 years of mining and the merging or acquisition of several different quarry operators. The present operator is Materials Service Corporation which purchased the quarry in 1938 and has continuously operated the quarry since that time.

Geology

The quarry operations at Thornton involve mining dolomite that makes up an ancient reef (Thornton Reef) that formed during the Silurian age (about 400 million years ago) a time when much of the U.S. Midwest was covered by a vast, inland, tropical sea. Thornton Reef is somewhat circular to elliptical in outline and approximately 1.5 miles in diameter (Figure 8). At the center of the reef (just northwest of the observation building), the reef originally had a maximum thickness of about 300 feet.

Thornton Reef is one of the numerous mound-shaped Silurian reefs (called “klintars”) that occur in the Chicago area. Stony Island is another example of such a mound-shaped reef. Others occur as submerged knolls or shoals in southern Lake Michigan (such as Oakland Shoal and Morgan Shoal shown in Figure 3).

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The development of a major quarry complex such as the one at Thornton results in many environmental and social issues for the surrounding area. Local urban development has been impacted by the presence of the quarry which, to varying degrees, forms an obstruction to roads and utilities. Dust, truck traffic, and local road wear are issues. The Thornton quarry, as with all quarries, has a limited life based on the volume of available resource and the rate at which it is extracted.

Thornton quarry is expected to remain an operational quarry for several generations to come, but then the issue will be how to use this expansive “hole in the ground.” Retired quarries have often been used as sites for landfills or as water reservoirs. At present, a plan is in place to use the North Pit at Thornton quarry as a floodwater retention basin as part of the Tunnel and Reservoir Plan (TARP) that is being built under selected areas of Cook County.

In some cases around the country, the life of a quarry operation has been extended by moving entire mining towns that were built next to the original quarry site. The towns were built atop some of the mineral deposit. As the map of the Thornton Reef illustrates, the reef dolomite extends under part of the town of Thornton between Vincennes Avenue and Chicago Road, under the commercial development (Menards Inc.) at Halsted Street and W. 175th Street, and beneath the cemetery located southwest of the Brown Derby pit.
Figure 8. Map of the Thornton quarry showing approximate edge of the reef and names of the five pits (from Mikulic and Kluessendorf, 1991).
References Cited


NOAA, Chart 14926, Chicago and South Shore of Lake Michigan, 1982 (4th ed.): NOAA, National Ocean Service, Rockville, Maryland (30 chart sheets, scales 1:10,000 and 1:60,000).

Other References


